WHAT IS CLAIMED IS:

1. A planar motor device comprising:

an armature unit including a plurality of armature coils arranged in a matrix shape along a guide surface, which have a rectangular current path; and

a magnetic pole unit arranged opposing said armature unit with respect to said guide surface, which has a plurality of thrust generating magnets having a rectangular magnetic pole surface with a side length longer than an arrangement period of said armature coil and is not equal to an integral multiple of said arrangement period, said plurality of thrust generating magnets arranged in a matrix shape in an arrangement period of an integral multiple of said arrangement period of said armature coils and having a different adjacent polarity of said magnetic pole surface in a row direction and a column direction, and

said armature unit and said magnetic pole unit relatively move in a direction along the guide surface.

2. A planar motor device according to Claim 1, said magnetic pole unit further comprising an interpolating magnet arranged on a magnetic flux path formed on a magnetic pole surface side of said thrust generating magnet opposing said armature unit, said path formed between said thrust generating magnets which are adjacent in said row direction and said column direction, said

interpolating magnet being a part of a magnetic circuit, and reinforcing a magnetomotive force.

3. A planar motor device according to Claim 1, wherein said thrust generating magnets are arranged in a shape of a two-by-two matrix.

4. A planar motor device according to Claim 1, wherein an external shape of a surface of said armature coil which opposes said magnetic pole unit is a square, and said magnetic pole surface of said thrust generating magnets is of a square shape.

5. A planar motor device according to Claim 4, wherein

a current path length on an outer side of said armature coil is respectively around 3 times longer than a current path on an inner side,

a magnetic pole surface length of one side of said thrust generating magnets is respectively 4 to 5 times longer than said current path on the inner side, and

said arrangement period of said thrust generating magnets is around 6 times longer than said current path on the inner side.

6. A planar motor device according to Claim 1, further comprising a first magnetic member to support said armature coils at a side opposite to said magnetic

pole unit.

7. A planar motor device according to Claim 1, further comprising a second magnetic member to support said thrust generating magnets at a side opposite to said armature unit.

8. A planar motor device according to Claim 1, further comprising at least one guide member arranged between said armature unit and said magnetic pole unit which is made of a material non-magnetic and non-conductive and forms the guide surface.

9. A planar motor device according to Claim 8, further comprising a supporting member attached to said magnetic pole unit and has a first vent portion to exhaust a pressurized gas to said guide surface, said supporting member being adapted to support said magnetic pole unit by air levitation via a predetermined air gap.

10. A planar motor device according to Claim 9, further comprising a base which includes said guide member and forms a closed space in its interior where said plurality of armature coils are arranged.

11. A planar motor device according to Claim 10, further comprising a cooling device which supplies a coolant to said closed space and cools said armature

coils.

12. A planar motor device according to Claim 9, further comprising a plurality of cases which respectively house said plurality of armature coils.

13. A planar motor device according to Claim 12, further comprising a cooling device to respectively cool an interior of said plurality of cases.

14. A planar motor device according to Claim 12, wherein an upper surface of said cases respectively structure said guide surface.

15. A planar motor device according to Claim 8, further comprising a base which includes said guide member and forms a closed space in its interior where said plurality of armature coils are arranged.

16. A planar motor device according to Claim 15, further comprising a cooling device which supplies a coolant to said closed space and cools said armature coils.

17. A planar motor device according to Claim 8, further comprising a plurality of cases which respectively house said plurality of armature coils.

18. A planar motor device according to Claim 17, further comprising a cooling device to respectively cool an interior of said plurality of cases.

19. A planar motor device according to Claim 17, wherein an upper surface of said cases respectively structure said guide surface.

20. A planar motor device comprising:

an armature unit including a plurality of armature coils arranged in a matrix shape along a guide surface, which have a rectangular current path; and

a magnetic pole unit arranged opposing said armature unit with respect to said guide surface including

a plurality of thrust generating magnets which have a rectangular magnetic pole surface and are arranged so as to have a different polarity of an adjacent magnet pole surfaces alternately, and

an interpolating magnet to reinforce a magnetomotive force, which is arranged on a magnetic flux path formed on a magnetic pole surface side of said thrust generating magnet opposing said armature unit, said path formed between said thrust generating magnets which are adjacent, and

said armature unit and said magnetic pole unit relatively move in a direction along the guide surface.

21. A planar motor device according to Claim 20, wherein an external shape of a surface of said armature coil which opposes said magnetic pole unit is a square, and said magnetic pole surface of said thrust generating magnets is of a square shape.

22. A planar motor device according to Claim 21, wherein

a current path length on an outer side of said armature coil is respectively around 3 times longer than a current path on an inner side,

a magnetic pole surface length of one side of said thrust generating magnets is respectively 4 to 5 times longer than said current path on the inner side, and

said arrangement period of said thrust generating magnets is around 6 times longer than said current path on the inner side.

23. A planar motor device according to Claim 20, further comprising a first magnetic member to support said armature coils at a side opposite to said magnetic pole unit.

24. A planar motor device according to Claim 20, further comprising a second magnetic member to support said thrust generating magnets at a side opposite to said armature unit.

25. A planar motor device according to Claim 20, further comprising at least one guide member arranged between said armature unit and said magnetic pole unit which is made of a material non-magnetic and non-conductive and forms the guide surface.

26. A planar motor device according to Claim 25, further comprising a supporting member attached to said magnetic pole unit and has a first vent portion for exhausting a pressurized gas to said guide surface, said supporting member being adapted to support said magnetic pole unit by air levitation via a predetermined air gap.

27. A planar motor device according to Claim 25, further comprising a base which includes said guide member and forms a closed space in its interior where said plurality of armature coils are arranged.

28. A planar motor device according to Claim 27, further comprising a cooling device which supplies a coolant to said closed space and cools said armature coils.

29. A planar motor device according to Claim 25, further comprising a plurality of cases which respectively house said plurality of armature coils.

30. A planar motor device according to Claim 29,

further comprising a cooling device to respectively cool an interior of said plurality of cases.

31. A planar motor device according to Claim 29, wherein an upper surface of said cases respectively structure said guide surface.

32. A planar motor device comprising:

a magnetic pole unit which has at least one magnet and moves along a predetermined guide surface in two-dimensional directions;

a supporting member attached to said magnetic pole unit and has a first vent portion to exhaust a pressurized gas to said guide surface, said supporting member being adapted to support said magnetic pole unit by air levitation via a predetermined air gap; and

a stator including a plurality of armature coils arranged at a side opposite to said magnetic pole unit in respect to a guide surface in two-dimensional directions along said guide surface.

33. A planar motor device according to Claim 32, wherein said magnetic pole unit is freely attachable to and detachable from and said supporting member.

34. A planar motor device according to Claim 33, wherein said supporting member has an attachment/detachment mechanism to have said magnetic

pole unit attached and detached.

35. A planar motor device according to Claim 34, wherein said supporting member comprises a second vent portion which exhausts a pressurized gas to said magnetic pole unit so as to support said magnetic pole unit by air levitation against a downward force when said magnetic pole unit is attached to said supporting member, said downward force acting in a direction of gravity and is a sum of a magnetic attraction force of said magnetic pole unit, said armature coil, and said stator and a weight of said magnetic pole unit itself.

36. A planar motor device according to Claim 35, wherein said supporting member further comprises a switching mechanism which switches an exhaustion of a gas between an exhaustion of a pressurized gas from said first vent portion and an exhaustion of a pressurized gas from said second vent portion.

37. A planar motor device according to Claim 32, wherein said supporting member further comprises a suction portion to vacuum chuck said supporting member to said guide surface, said supporting member being able to control a dimension of said predetermined air gap by adjusting an exhaustion pressure of said pressurized gas released from said first vent portion and a vacuum suction force of said suction portion.

38. A planar motor device according to Claim 32, further comprising a base which forms said guide surface as well as form a closed space in its interior where said plurality of armature coils are arranged.

39. A planar motor device according to Claim 38, further comprising a cooling device which supplies a coolant to said closed space and cools said armature coils.

40. A planar motor device according to Claim 32, further comprising a plurality of cases which respectively house said plurality of armature coils.

41. A planar motor device according to Claim 40, further comprising a cooling device to respectively cool an interior of said plurality of cases.

42. A planar motor device according to Claim 40, wherein an upper surface of said cases respectively structure said guide surface.

43. A planar motor device comprising:

a magnetic pole unit which has at least one magnet and moves along a predetermined guide surface in two-dimensional directions;

a base which forms said guide surface and has a

closed space formed in its interior;

an armature unit including a plurality of armature coils housed in said closed space of said base which are arranged in two-dimensional directions along said guide surface at predetermined intervals; and

a cooling device which supplies a coolant into said closed space to respectively cool said armature coils.

44. A planar motor device according to Claim 43, wherein

said closed space is divided by a dividing member arranged on an opposite side to said guide surface of said plurality of armature coils into a first chamber where said plurality of armature coils are housed, and a second chamber formed by a remaining space, and

an inlet opening and an outlet opening are respectively formed in said dividing member, and

a coolant path is formed in said base in which a coolant supplied from said cooling device flows into said first chamber via said inlet opening and then flows out to said second chamber via said outlet opening.

45. A planar motor device according to Claim 44, further comprising secondary cooling fins respectively made of a high thermal conductive material and arranged on said path of said coolant which flows out through said outlet opening.

46. A planar motor device according to Claim 43, wherein

said closed space formed within said base is divided into a plurality of small chambers which respectively house said armature coils, and

said plurality of small chambers respectively have an inlet opening and an outlet opening to supply said coolant from said cooling device.

47. A planar motor device according to Claim 46, further comprising a plate-shaped non-magnetic member which serves as said guide surface and is arranged so as to cover said plurality of small chambers.

48. A planar motor device according to Claim 46, wherein

said small chambers are respectively structured of a plate-shaped member arranged at a side opposite to said guide surface of said plurality of armature coils, and a plurality of box-shaped cases which respectively have an opening on a surface opposing said plate-shaped member and have an opposite side of said surface formed as the guide surface, and

an inlet opening and an outlet opening to respectively supply a coolant to said small chambers are formed in said plate-like member in respect to said plurality of cases.

49. A planar motor device according to Claim 48, wherein terminals of said armature coils are exposed from an open end of said case, and a socket portion where said terminal is fitted is provided in a corresponding part of said plate-shaped member.

50. A planar motor device according to Claim 48, wherein

an additional chamber is arranged in an opposite side to said guide surface of said small chambers within said base, and

a coolant path is formed in said base in which a coolant supplied from said cooling device flows into said case respectively via said inlet opening and then flows out to said additional chamber via said outlet opening.

51. A planar motor device according to Claim 48, further comprising secondary cooling fins respectively made of a high thermal conductive material and arranged on said path of said coolant which flows out through said outlet opening.

52. A planar motor device according to Claim 43, wherein

said armature coils are respectively a ring-shaped coil with a space formed in its central portion, and

said cooling device supplies said coolant to each of said armature coils via said space formed in its

central portion from an opposite side of said guide surface of said armature coils.

53. A planar motor device according to Claim 52, further comprising straightening fins to regulate a path of said coolant which flows from said space formed in its central portion to its surroundings.

54. A planar motor device according to Claim 43, wherein

said base has a plurality of coolant injecting joints and at least one coolant discharging joint attached, and

said cooling device has an end respectively connected said coolant injecting joint via a coolant supplying pipe, and also has another end connected to said coolant discharging joint via a coolant discharging pipe.

55. A planar motor device comprising:

a magnetic pole unit which has at least one magnet and moves along a predetermined guide surface in two-dimensional directions;

a plurality of armature coils arranged with respect to said guide surface at predetermined intervals in two-dimensional directions along the guide surface at a side opposing said magnetic pole unit; and

a plurality of cases which individually house said

plurality of armature coils.

56. A planar motor device according to Claim 55, further comprising a cooling device to respectively cool an interior of said plurality of cases.

57. A planar motor device according to Claim 55, wherein an upper surface of said cases respectively structure said guide surface.

58. A stage device comprising:

a planar motor device according to Claim 1;

a movable body which moves integrally with one of a magnetic pole unit and an armature unit; and

a controller which controls at least one of an amount and direction of electric current supplied respectively to said armature coils of said armature unit.

59. A stage unit according to Claim 58, further comprising:

a position detecting system which detects a positional relationship between said magnetic pole unit and said armature unit; and

said controller controls at least one of said amount and direction of electric current supplied respectively to said armature coils of said armature unit according to a detecting result of said position detecting system.

60. A stage device according to Claim 59, wherein said controller

specifies respectively an intersection area between a magnetic flux path due to said magnetic unit and said armature coils based on said detection result of said position detecting system, and

controls at least one of said amount and direction of electric current supplied respectively to said armature coils according said specified intersection area.

61. An exposure apparatus comprising:

an illumination system which emits an energy beam for exposure; and

a stage device according to Claim 58, which mounts an object to be arranged on a path of the energy beams.

62. An exposure apparatus according to Claim 61, wherein said object is a substrate onto which a predetermined pattern is transferred by exposing said energy beams.

63. A making method of an exposure apparatus comprising:

providing a planar motor device according to Claim 1;

providing a movable body which moves integrally with one of a magnetic pole unit and an armature unit; and

providing a controller which controls at least one of said amount and direction of electric current supplied respectively to said armature coils of said armature unit.

64. A making method of an exposure apparatus according to Claim 63, further comprising:

providing a position detecting system which detects a positional relationship between said magnetic pole unit and said armature unit.

65. A device manufactured by using an exposure apparatus according to Claim 61.

66. A device manufacturing method including a lithographic process, wherein said lithographic process uses said exposure apparatus made by said making method according to Claim 63.